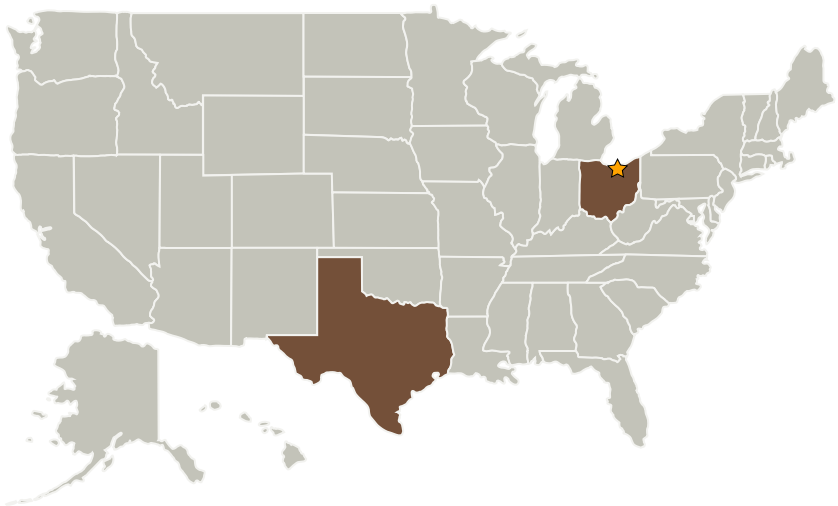
Fully Printed Flexible 4-Bit 2D (4x4) 16-Element Phased Array Antenna for Lunar Surface Communications, Phase II

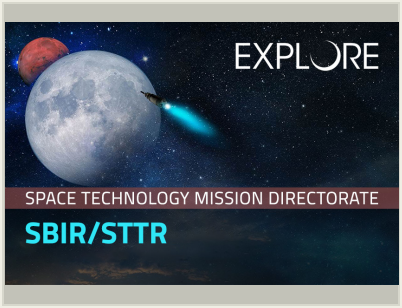
Completed Technology Project (2009 - 2011)

Project Introduction

NASA's future exploration missions focus on the manned exploration of the Moon, Mars and beyond, which will rely heavily on the development of a reliable communications infrastructure from planetary surface-to-surface, surface-to-orbit and back to Earth. Flexible antennas are highly desired in many scenarios, such as pressurized rovers, pressurized habitats, space suits, and any other applications that require conformal profiles. Existing flexible electronics has an intrinsic low switching frequency due to their low carrier mobility. The CNT network in solution we used has carrier mobility as high as 46770cm2/V's and a large current-density carrying capacity of ~1000 mA/cm2, corresponding to a high carrying power of over 2000mW/cm2. Such high carrier mobility and large current carrying capacity allow us to achieve high-speed (>100GHz), high power flexible electronic circuits and antennas. A prototype of a fully printed S-band 4-bit 2D (4x4) 16-element PAA on flexible substrate such as Kapton, including FET based T/R module and phase shifters will be developed and optimized. For the FETs working as switches/amplifiers, the switch speed, on-off ration, the gain, noise figure, insertion loss and power consumption will be significantly improved through finding better gate dielectric material, increasing the CNT purity and the optimizing the FET geometry including the channel length and the channel width. Performance features of the printed PAA will be characterized including frequency/bandwidth, gain/efficiency, and power consumption. To survive NASA's stressing environment, the operating temperature range will be investigated and the performance under shock and vibration will be evaluated. The humidity test and aging tests will also be carried out. Radiation hard test will also be carried out in Phase II under the program manager's guidance.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Omega Optics, Inc.	Supporting Organization	Industry	Austin, Texas

Primary U.S. Work Locations	
Ohio	Texas

Project Transitions

January 2009: Project Start

July 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves